



Wind turbines located near radar systems can degrade the air surveillance picture. *Photo of Travis Air Force Base, California.*
Photo credit: Bryan Miller.

Wind Turbine Radar Interference Mitigation

Wind energy is one of the fastest growing sources of new electricity supply in the United States. As wind development continues to grow and expand to new areas of the country, so does the possibility that some turbines would be located within the line of site of radar systems. If not mitigated, such wind development could cause clutter and interference for radar systems involved in air traffic control, weather forecasting, homeland security, and national defense missions.

Under a Memorandum of Understanding signed in 2014 and building off the successful Interagency Field Test & Evaluation radar mitigation testing campaigns, a consortium of federal agencies composed of the U.S. Department of Defense (DOD), the U.S. Department of Energy (DOE), the Federal Aviation Administration (FAA), and the National Oceanic and Atmospheric Administration (NOAA) established the Wind Turbine Radar Interference Mitigation (WTRIM) Working Group (WG) to address these conflicts. The Department of Homeland Security (DHS) and the Bureau of Ocean Energy Management (BOEM) are observers of the WTRIM WG.

Through collaborative activities and coordinated investments, the WTRIM WG seeks, by 2025, to fully address wind turbine radar interference as an impact to critical radar missions, ensure the long-term resilience of radar operations in the presence of wind turbines, and remove radar interference as an impediment to future wind energy development. DOE partners with multiple laboratories (Sandia National Laboratories, Lawrence Berkeley National Laboratory, and MIT Lincoln Laboratory) who assist in these efforts.

Wind Turbine Radar Interference Mitigation Federal Strategic Themes

Improving the capacity of government and industry to evaluate the impacts of existing and planned wind energy installations on radar systems.

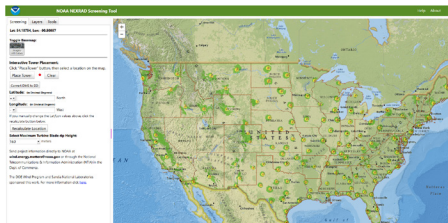
Developing and facilitating the deployment of hardware and software mitigation measures to increase the resilience of existing radar systems to wind turbines.

Encouraging the development of next-generation radar systems that are resistant to wind turbine interference.



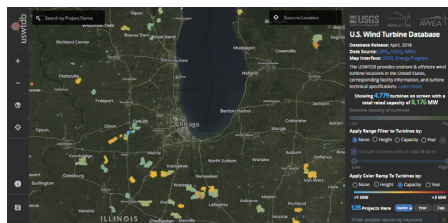
Improving Evaluation of Impacts

Mitigating the interference that wind turbines have on radar systems begins with modeling proposed wind turbines and simulating the impact they may have on radar systems. DOE has partnered with Sandia National Laboratories and NOAA to develop a public NOAA NEXRAD Radar Screening Tool, an online Geographic Information System website addressing the potential impacts of wind energy on weather forecasts and on NOAA's severe weather warning system.



The NOAA NEXRAD Screening Tool
pikes.peakspatial.org/NOAA/ScreeningTool/

DOE has also partnered with Lawrence Berkley National Laboratory, the U.S. Geological Survey, and the American Wind Energy Association to create the U.S. Wind Turbine Database, a database that includes all installed wind turbines in the United States. The database currently includes over 57,000 turbines from 43 states, plus Guam and Puerto Rico.



U.S. Wind Turbine Database
Photo Credit: Ben Hoen, LBNL
eerscmapp.usgs.gov/uswtodb/

Developing Mitigation Measures

Near-term, the WTRIM Working Group works to reduce risk for promising off-the-shelf solutions, particularly infill radar systems. A variety of candidate infill radars were rigorously tested under the Interagency Field Test & Evaluation campaign.

To deploy these systems and ensure that they meet the performance requirements of the government, DOE and other agencies are pursuing Pilot Mitigation Projects, which enable government-industry partnerships that facilitate wind energy development as well as the operational deployment and long-term, onsite testing of solutions that mitigate wind turbine-radar interference.

Current Pilot Mitigation Projects include the Travis Air Force Base (AFB) FAA STARS Infill Radar Integration Project and the Cannon AFB Analysis of Alternatives (AoA) Project.

The Cannon AFB AoA Project determined the base's initial mitigation solution and identified follow-on enhancement activities. The Travis AFB Pilot Mitigation Project will develop an Infill Radar Interface Control Document, validate safety standards, and analyze system performance within and around wind plants.

The Pilot Mitigation Project manages the risk to stakeholders while:

- Maintaining the current quality of the air picture;
- Reducing the time required to implement mitigation solutions;
- Minimizing the cost of delivering effective air surveillance services to government users; and
- Meeting renewable energy goals.

Encouraging Next-Generation Radar Systems

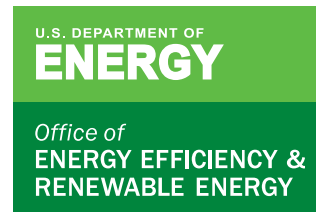
Many of the radar systems currently impacted by wind turbine interference are likely to be upgraded significantly or replaced by next-generation radars over the next few decades. Resilience to wind turbine interference should be a key design requirement for these next-generation radar systems.



Infill radars like the ones picture above are being vetted as a mitigation measure.

Photo credit: Bryan Miller and Jason Biddle, MIT Lincoln Laboratory

A key role of the WTRIM Working Group, through Sandia National Laboratories and MIT Lincoln Laboratory and other agencies, is to ensure that next-generation systems include provisions for wind turbine requirements from the early stages of the development and acquisition process. This is particularly true for the recent federal initiative called the Spectrum Efficient National Surveillance Radar or SENSr. ■



For more information, visit:
energy.gov/eere/wind